PMC STRATEGIC PLAN (10/28/03 draft – edited 11/11/03 and by PMC on 11/17/03)

STRATEGIC PLAN TABLE OF CONTENTS (short outline)

1. Executive summary
2. Background on FL Bay (with map), science & management, including agency reponsibilities [about 2-3pages]
3. PMC mission, structure, history, statement on role of science in management [brief description –1-2 pages]
4. Strategic plan overview [about 4 page]
    - Overview intro – general approach (ref to linkage with watershed & mgmt needs)
    - Geographic scope
    - Specification of management issues / questions – listing of primary and secondary stressors (extent of human influence – as in D. Morrison table)
    - Specification of management programs / projects (thumbnail background on CERP, CSOP, MFL, etc.)
    - Scientific approach
        - Conceptual model to prioritize needs
        - Definition of targets and ecological needs (importance of retrospective research)
        - Status and trends (monitoring and assessment)
        - Synthesis through numerical modeling (with dependence on ongoing research)
        - Communication – exchange (with results) with scientific community, management (adaptive assessment), public
    - PMC implementation plan – structure and function of PMC and teams
5. Details of scientific approach (with subsections following above bullets) [10-20 pages]
6. Details of PMC implementation plan [about 5 pages]

STRATEGIC PLAN – EXTENDED OUTLINE

1. Executive summary
2. Background on FL Bay (with map), science & management [brief orientation to bay only only– much background will be provided in Strategic plan overview below] – include sketch of agency responsibilities for management
3. PMC mission, structure, history [brief description]
   - why we exist – complex system - need for coordination, communication, openness – proactively address information needs

   PMC structure and history – emphasis on accomplishments of program – what we know now that we didn't know when we started
   - General role of science in environmental management
4. Strategic plan overview
   - Overview intro – purpose of this strategic plan – priority of providing scientific basis for ecosystem management, particularly with regard to watershed
   - Geographic scope with reference to <u>primary</u> region (= FL Bay, coastal ponds and bays of north FB coast, WW Bay = region of management focus for protection and restoration) and <u>secondary</u> region (= adjacent systems that interact with FL Bay = areas that affect or are affected by management actions /restoration actions in or for primary region = coast to Lostman's, Gulf shelf, FKNMSanctuary) – should refer to emphasis on linkage between watershed and estuaries
   - define management issues / questions – listing of primary and secondary stressors and extent of human influence [*agency responsibilities could go here if more appropriate than in section 2 above*]
     - include table of stressors, extent of human influence plus thumbnail description (table similar to D. Morrison's)
   - provide table of projects with thumbnail descriptions – include CERP (FBFKFS, C111 Spreader, Tidal Restoration, RECOVER), CSOP (C111 & Modwaters), MFLs, other?
   - Scientific approach
     - Initial step – use of conceptual ecosystem model linking stressors to ecosystem structure and function, with key attributes and indicators, pointing toward

information needs (to understand stressor effects and resultant habitat/population responses).
    - define targets and ecological / hydrologic "needs" (for species / communities / indicators that are highlighted in conceptual model) – requires historical info (palaeo research) to provide basis for restoration - understanding of causes of change (natural vs anthropogenic)
    - Focus and sustain status and trends monitoring and assessment of key attributes and functions – relate to key ecological indicators that enable us to translate data to human perception of "integrity" or "health")
    - synthesize and predict management effects through numerical modeling (with definition of data needs, including research needs (mechanistic understanding of cause and effect) – show integrated modeling diagram
- PMC implementation plan – structure and function of PMC and teams
    - communication – connections with scientific community, management projects (as part of adaptive approach), and public
    - more

5. **Science plan –** Details of scientific approach (with subsections following above bullets) [10-20 pages]

5.1. FB conceptual model (Science plan basis w/ model figure) and how model is used to identify performance measures, numerical model requirements, data needs. Need several model diagrams: 1) top tier with regional scale (Ever-Mangrove-Bay-Keys connections, transport); 2) zoom in on local system scale with at least 3 models (bay, mangrove zone, marine boundary (with Keys). [diagram with Bay model, second diagram with simple bay model box and connections to watershed and adjacent systems] – details of conceptual model here

Show & describe model diagram [similar to RECOVER, but with more dynamic feedbacks and spatial context]

- stressors / major forcings / large-scale spatial links – include natural and anthropogenic factors
- major components & functions

- identity of critical uncertainties – based on past work, reviews – leading to identification of research needs

key points:

- physiochemical controls of bay by restricted flow (banks), shallow depth, carbonate chemistry influence on P availability
- wide range of salinity possible because of shallow depth, long residence time (impact of closing passes), human influence
- biotic feedbacks – high light energy in shallow system – Importance of SAV, algae, and mangrove feedbacks to physical and chemical dynamics, including biogenic bank accretion in the face of sea level rise - with salinity effects
- SAV as critical habitat – vulnerable because of sulfide toxicity / O2 depletion – salinity and light as factors – key to upper trophic level structure and function
- SAV light requirements / algal blooms / nutrient supplies – question of cause of algal blooms – role of Everglades DOM
- Hard bottom communities
- Management questions focus on functional linkage of Ever to Bay and Bay to Keys
- Need to account for sea level rise and changing link to Gulf and Atlantic
- Tropical storms

5.1.1 Mangrove zone sub model

5.1.2 **FB-Keys conceptual sub-model** (as above) – focus solely on magnitude and effects of Bay exchanges (interactions) – brief

5.1.3 Marine (Gulf/Atl) sub model (*could be single Keys/Atl/Gulf submodel*)

5.2. Defining targets for protection and restoration – ecological needs of system and key components – paleao / history here – challenge of defining ecosystem "health" or "integrity" – proper spatial and temporal heterogeneity – at least need to outline PMC and scientific process leading to such definitions. Describe performance measures associated with RECOVER (AAT and RET), FBFKFS, CSOP). Use Biscayne Bay Plan figures as model for linkage to management – Rick Alleman has figures (flow diagram of management objective, target, etc).

5.3. Status and Trends details – emphasis on salinity, nutrients, habitat, with key species [similar to RECOVER, but what else?] – need to sustain monitoring

5.4. Synthesis and prediction – the heart of the science plan– central role of numerical models for bringing people, data, hypotheses together, testing hypotheses (and management alternatives). Identify uncertainties and prioritize research (use FL Bay synthesis chapter as guide to specifics). Provide output (predictions) to managers and public. [PMC recommendation on 11/17: lay out main management questions here – what kinds of predictions are needed? Links to issues should be explicit. Describe physical alterations that are to be done or are being considered.]

Ever-FL Bay linkage - organized by region / ecological zone

- Hydrodynamic & hydrology modeling program (needed at system-wide scale)
- Mangrove zone modeling program – include hydrol, biogeochem/wq, plant, UTL dynamics
- FB ecological / seagrass system modeling program – w/ plankton/wq/UTL
- Hardbottom modeling program (with Keys)
- Model integration / total system prediction program [describe data output needs]

ISSUES TO CONSIDER: organizational problem – large burden on integration across ecosystem type and region – FB team will be huge

flow of info is not disciplinary – issue oriented, emphasis on connections, should match earlier diagrams

physical modeling team connects with 3 component zones to yield integrated output

[END OF 10/28/03 OUTLINE REVIEW AT ENP (Rudnick, Morrison, Perry, Keller) plus PMC review on 11/17/03]

Keys linkage as distinct issue in strategic plan [probably last of 3 regional / ecological zone parts of plan – *this section does not necessarily mesh right here in outline*]: needs to include hydrodynamic, water quality, reef modeling / predictions.

An important management issue is whether Florida Bay restoration can be promoted via opening Keys' passes that were occluded by the Flagler railway and Overseas Highway. This involves understanding of the influence of the Atlantic Ocean and Keys on the bay. Concurrently, the influence of the Bay on the Keys reef tract, and how this is likely to change with hydrologic restoration and potential restoration of Keys' passes, is a high research and modeling priority. Organization units could center around modeling groups.

- Hydrodynamic model development group (not necessarily distinct from bay group); address data needs and model development associated with oceanic, GOM, and local Keys waters – predicting FL bay influence on reef tract salinity and temperature
- Water quality & reef model development group – predicting light, nutrient loads, algal biomass; assess effect of Florida Bay on coral reef (cumulative stress, spatially explicit answers regarding extent and magnitude of Bay influence, risk assessment approach?). Also, greater attention on western Syringodium bed – potential for die-off and effects on Keys? Is this bed increasing as function of regional (GOM) nutrient enrichment?

6. PMC program implementation [< 5 pages]

provide PMC functional flow diagram

- Adaptive management as framework – need frequent output to managers (interim products) – state where PMC fits in – how we act in concert with CERP and other groups – role of science and feedbacks.
- Re-organization of teams by issues, not disciplines.
- Development of explicit conceptual models as tool to focus people on critical issues.
- Support of status and trends monitoring [is RECOVER MAP sufficient? How do we sustain parsimonious program?
- PMC helps to identify research needs (prioritize) and process for meeting needs (partly based on modeling framework)
- Oversight of program – engagement of greater scientific community, make best use of local expertise; independent peer reviewModel strategies – importance of model coordination (compatibility); different models for different purposes (not neglecting simple models as screening tools and for testing hypotheses), NEED FOR CROSS CUT ACROSS MODELING GROUPS, importance of community models?

- Data management and provision to models – expansion of the Standard Data Set (in time, space, beyond physical parameters). How do we promote better data sharing (with documentation)? Oversight of data (QA issues)?
- Engagement with management projects – we help to supply information for target development, performance measure development, model structure and data, interpretations of predictions. Also explain real world dynamics – monitor and describe status and trends, research to attribute on cause and effect (effects of managed and unmanaged factors).
- Communication – among scientists, with project managers & engineers, with executive mangers, public. – work with FBFKFS and RECOVER
- Greater interaction with LTER for EVER linkage; overall issue of how to be more inclusive of universities – promotion of consortium (CESU status?)
- Greater interaction with FKNMS for Keys linkage.
- Facilities issue – Interagency Science Center
- Executive officer for PMC? Staffing?

Additional ideas expressed at 11/17 PMC meeting:

- Need to develop strategy to address long term resource ($$) needs – communicate needs, uncertainties, constraints (including policy constraints) – be explicit about assumptions regarding base of funding
- Need for feedback from agencies – written plans – descriptions of agency roles (mostly scientific roles)
- Considerations: CERP implementation, FKNMS mandate, research reserves, Endangered Species Act (NMFS)

APPENDIX: regulatory compliance and permitting guidelines for research in FL Bay (info source for prospective researchers) – list of permits too?

[BELOW ARE COMMENTS FROM TIM FITZPATRICK (with reply comments in caps from DR)]

> David/Doug - Below are some thoughts I had earlier on the draft PMC strategic
> plan, which I should have sent before the last meeting but didn't have the
> time. The majority of these thoughts were discussed in some fashion at the
> last meeting and may already be incorporated in the draft you're crafting.
> For what it's worth, here they are:
>
> 1. Improving Predictive Power:
> The draft strategic plan focused primarily on modeling, which may imply (to
> some) that the focus of future research goals will be nearly entirely on the
> feasibility study. I see the feasibility model as one component under a
> broader focus of improving the power of predicting ecosystem response to
> change. Improving predictive power entails not only the development of
> numerical and statistical models, but also includes the refinement of
> conceptual models, data gathering and the establishment of data needs. The
> SOP alluded to the need to establish interconnections between the five major
> themes of the last strategic plan. It appears there may still be significant
> research needs in that area that should be identified or at least recognized
> in the strategic plan.
YES, YES, YES
>
> 2. Providing Guidance to Management
>
> In this area again, the SOP recommended a strategy for providing useful
> feedback to resource managers and stakeholders involving in defining policy.
> One mechanism of accomplishing that is to provide predictive tools, however
> there also exists a need to define restoration or management targets and
> further refine or develop performance targets. It would appear that further
> research is needed in those areas and that need should be reflected in the
> strategic plan.
THIS POINTS TOWARD CONTINUING RETROSPECTIVE (PALAEO, ETC.) RESEARCH, BUT MUCH OF THE TARGET DEVELOPMENT IS A JOINT SCIENTIFIC AND SOCIAL ENDEAVOR....I THINK I WOULD LEAVE THE MORE PROJECT SPECIFIC TARGET DEVELOPMENT TO THE PROJECTS AND NOT THE PMC PLAN. WE SHOULD EMPHASIZE, HOWEVER, THAT TARGETS ARE AN IMPORTANT PART OF THE RESTORATION PROCESS AND THAT THE SCIENCE TEAMS NEED TO BE ENGAGED IN THEIR FORMULATION. HOW THE PMC PROMOTES THAT IS ANOTHER MATTER.

>
> 3. Communication and Implementation Plans
>
> The strategic plan should incorporate a clear strategy for implementing the
> recommendations of the SOP and the goals put forth in the plan. The process
> of collecting pertinent information to feed into the development of
> predictive models and of providing information necessary for adaptive
> management is complex given the varying missions of the agencies involved.
> The plan should identify, as clearly as possible, the roles of the agencies
> involved in implementing the plan to avoid redundant efforts to ensure there
> are no critical gaps in information. The plan should also outline how
> restoration and management goals are communicated to all stakeholders so
> that, should the ecosystem be managed toward a different target than today,
> adverse stakeholder reaction may be minimized.
YES, WE NEED TO LAY OUT HOW WE INTEND TO IMPLEMENT AND COMMUNICATE OUR PLAN AND RESULTS IN AN EFFICIENT, COLLABORATIVE MANNER. THE PAST PROCESS WAS TO SHARE IMPLEMENTATION PLANS AND TUNE FROM THERE. AGENCY ROLES & RESPONSIBILITIES CAN BE SPECIFIED IN SOME CASES (E.G. CERP PROJECTS), BUT THEY ALSO SHIFT WITH POLITICAL WINDS AND BUDGETS....I GUESS OUR PLAN WILL HAVE ITS OWN ADAPTIVE ELEMENT.
>

OUTLINE for Oct 14 draft [NOTE: plan below based on linkage organization not accepted by PMC at 10/14/03 meeting]

Section 4.1 Science plan development: Ever-FL Bay linkage program

Present conceptual model diagram with critical forcings, stressors [noting connections to management], structural components, functions, feedbacks, performance measures.

Identify critical management issues

Objectives of Ever-Bay linkage

Identity of stressors

Key PM descriptions

Key uncertainties & hypotheses

Numerical models in development or needed for synthesis and prediction

Model status / data needs

4.2. Science plan development: FL Bay – Keys linkage program

As above

Section 4.3 Conceptual implementation model

Figure of management projects

Table of factors that can be managed (what else?)

Figure of integrated models – priority of synthesis and model development

Need for team cross cuts

Description of communication plan

PMC STRATEGIC PLAN (10/12/03 draft)

1) Exec summary

2) PMC mission

- why we exist – complex system - need for coordination, communication, openness – proactively address information needs
- PMC structure and history – emphasis on accomplishments of program – what we know now that we didn't know when we started

3) Background on FL Bay ecosystem and management

- Ecosystem history, stressors, and change
- Causes of change: human influence and perception of influence
- Value of ecosystem
- Commitment to protection and restoration
- Science (monitoring, research, modeling) as foundation to fulfill commitment – role of adaptive management
- Summary of major projects (CERP and non-CERP)

4) Strategic plan overview

Based on two types of conceptual models (to be drawn and presented in sections 4.1 and 4.2 below)

Emphasis on:

- ecosystem linkages (Everglades-FL Bay; FL Bay–Keys/Reef?)
- anthropogenic stressors as causes of change
- communicating information to managers and public

Conceptual ecosystem model – identifying stress, hypothesized human influence, simplest depiction of ecosystem structure and function.

Conceptual implementation (science management) model (linkage to management – identify key projects / management input routes)

Strategic plan organization as follows.

A. Science Plan -

Two sections for each landscape linkage unit (Ever-FL Bay and Bay-Ocean, Keys)

For each unit, describe stressor based issue (identify management projects & questions per linkage unit)

For each unit, scientific objectives & components, relating to stressor based issues and interactions of issues. This includes statements of objectives, performance measure identity, major uncertainties and hypotheses, modeling approach and focus (for hypothesis development and testing plus alternative evaluation), identity of data needs.

B. Implementation plan – how we organize our effort [could be embedded in A – e.g. with list of clients and mechanisms to get info to clients, but there would be a great deal of repetition for two units] – suggest that separate, global section for implementation is better – key part is communication plan for information transfer.

[QUESTION: Geographic scope – include Biscayne? Southwest Coast? Keys? I suggest that we should include from Lostman's to Keys, but have separate plan for Biscayne. However, if emphasis on management, may be best to include all systems, in order to assess trade-offs among systems.]

4.1. Florida Bay Conceptual Ecosystem Model

Show & describe model diagram [similar to RECOVER, but with more dynamic feedbacks and spatial context]

- stressors / major forcings / large-scale spatial links
- major components & functions
- identity of critical uncertainties – based on past work, reviews

key points:

- physiochemical controls of bay by restricted flow (banks), shallow depth, carbonate chemistry
- wide range of salinity possible because of shallow depth, long residence time, human influence

- biotic feedbacks – high light energy in shallow system – SAV, algae, mangrove – feedbacks to physical dynamics, including biogenic bank accretion in the face of sea level rise
- SAV as critical habitat – vulnerable because of sulfide toxicity / O2 depletion – salinity and light as factors – key to upper trophic level structure and function
- SAV light requirements / algal blooms / nutrient supplies – question of cause of algal blooms – role of Everglades DOM
- Management questions focus on functional linkage of Ever to Bay and Bay to Keys
- Need to account for sea level rise and changing link to Gulf and Atlantic

4.2. Florida Bay PMC Conceptual Implementation Model

Can a set of processes be illustrated in a single model? May require two: map with projects and factors influenced plus model linkage / information flow diagram.

- What can be managed for protection & restoration? Fresh water (QQTD), Keys passes, Keys' land use / wastewater / stormwater, access (boating), fishing
- Projects: CSOP, MFLs, CERP (FBFKFS, C111 Spreader, L31 Pilot, Decompartmentalization, RECOVER, water reservations; Biscayne Bay coastal wetlands, Wastewater Reuse); ENP internal management programs (exotics, human use, prop scars); endangered species (ENP, USFWS, NMFS); FKNMS water quality protection program, reef protection (?).
- PMC role:
    - helps to evaluate and provide scientific basis for ecological targets, performance measures, develops credible predictive tools, interprets status and trends and predictions;
    - communicates results to other scientists, reviewers, managers, and public
    - continues to organize and implement scientific programs to meet these needs
- Emphasis in PMC implementation plan:
    - coordination, communication, data and idea sharing among scientists (follow path of past plan, but needs work – greater emphasis on databases), continued open review;

- help to specify ecological goals for projects (performance measure targets, based partly on ecosystem history);
- Models are our centerpiece –
    - improve conceptual models as communication & educational tools (synthesizing & translating what we know now and identifying what we need to know);
    - develop and apply numerical models – in concert with project needs – show model flow diagram
    - improve communication of numerical model results – develop summaries / diagrams of model outputs (data, inferences, performance measures) for project managers, executive managers, and public
    - standardize "state of the bay" / "state of the restoration" report cards – e.g. on website – easy to understand formats –
    - public lectures to educate press and public and build credibility
- how do we better link with existing CERP and non-CERP processes (including Task Force / Working Group)?

5) PMC Scientific Priorities

5.1. EVER-FB linkage

Most management projects and issues involve the hydrologic and ecologic connections of Florida Bay and the Everglades. Questions 1 and 2 of the last PMC strategic plan addressed aspects of this linkage. In this plan, we directly focus on describing and predicting the nature of the Everglades – FL Bay linkage with regard to major ecosystem dynamics. Organizational units focus on models being developed. Goals are to build predictive capability to assess water delivery alternatives (QQTD), Keys passes alternatives, influence of sea level rise. Outputs of models will be focused on management performance measures. However, models also used as tool to organize and present current information, hypotheses, and test these hypotheses.

- Hydrologic & hydrodynamic modeling group – includes both upland and bay model development working groups and associated field groups; consider data inputs, continuing data needs. Unknowns to be addressed: role of non-point freshwater sources (groundwater, seepage), GOM exchange, SRS plumes through Gulf to Bay, Keys passes effects on residence time & salinity (fate of Everglades water), internal issues of bank bathymetry, seagrass friction…priorities? Also, long-term need to at least monitor changes in bathymetry (mud bank responses to restoration and sea level rise)
- Water quality modeling group – includes studies of algal bloom controls, SAV processing. Unknowns to be addressed (priorities underlined): mangrove zone nutrient processing (retention and release), mangrove zone net ecosystem production (soil accretion or subsidence), nutrient loads to bay (budgets), nutrient cycles, [fate and effects of DOM, algal (benthic and pelagic) productivity, N fixation, denitrification, SAV processing (nutrient demand, decomposition), below-ground P dynamics in carbonate mud (root effects), controls of algal bloom dynamics. Contaminants? [NOTE: LINKAGE TO OTHER MODELING GROUPS NEEDS TO BE STATED]
- Habitat modeling group – SAV as focus – effects of salinity (high, low, variability), nutrient loads, turbidity, light, sulfide, factor interactions. Where do we stand with need and ability to assess hard bottom habitat? Mangrove habitat?
- Upper trophic level modeling group – responses to habitat, water quality changes; larval supply & hydrodynamics as factors; human influence via harvesting – strategies for modeling? Development of both statistical and dynamic models. Focus on small set of performance measures and models to predict them – data needs?

[Organizational issue – how to get cross links among groups – project organization (e.g. CERP PDTs) could do this, but are usually unwieldy; may need small, question specific cross-cuts, such as for larval transport or SAV friction. Drafting explicit conceptual models, with zoom in on cross-cut issues may be helpful].

5.2. FB – KEYS linkage

An important management issue is whether Florida Bay restoration can be promoted via opening Keys' passes that were occluded by the Flagler railway and Overseas Highway. This involves understanding of the influence of the Atlantic Ocean and Keys on the bay. Concurrently, the

influence of the Bay on the Keys reef tract, and how this is likely to change with hydrologic restoration and potential restoration of Keys' passes, is a high research and modeling priority. As in section 7.1, organization units center around modeling groups.

- Hydrodynamic model development group (not necessarily distinct from bay group); address data needs and model development associated with oceanic, GOM, and local Keys waters – predicting FL bay influence on reef tract salinity and temperature
- Water quality & reef model development group (probably distinct group) – predicting light, nutrient loads, algal biomass; assess effect of Florida Bay on coral reef (cumulative stress, spatially explicit answers regarding extent and magnitude of Bay influence, risk assessment approach?). Also, greater attention on western Syringodium bed – potential for die-off and effects on Keys? Is this bed increasing as function of regional (GOM) nutrient enrichment?

6) PMC Program Implementation

provide PMC functional flow diagram

- Adaptive management as framework – need frequent output to managers (interim products)
- Re-organization of teams, reviews?
- Development of explicit conceptual models as tool to focus people on critical issues.
- Support of status and trends monitoring
- Identification of research needs and meeting needs (partly based on modeling framework)
- Oversight of model development – engagement of greater scientific community, make best use of local expertise.
- Model strategies – importance of model coordination (compatibility); different models for different purposes (not neglecting simple models as screening tools and for testing hypotheses), NEED FOR CROSS CUT ACROSS MODELING GROUPS, importance of community models?
- Data management and provision to models – expansion of the Standard Data Set (in time, space, beyond physical parameters). How do we promote better data sharing (with documentation)?

- Engagement with management projects – we help to supply information for target development, performance measure development, model structure and data, interpretations of predictions. Also explain real world dynamics – monitor and describe status and trends, research to attribute on cause and effect (effects of managed and unmanaged factors).
- Communication – among scientists, with project managers & engineers, with executive mangers, public.
- Greater interaction with LTER for EVER linkage; overall issue of how to be more inclusive of universities – promotion of consortium (CESU status?)
- Greater interaction with FKNMS for Keys linkage.
- Facilities issue – Interagency Science Center